

**NATURAL RESOURCES CONSERVATION SERVICE
FIELD OFFICE TECHNICAL GUIDE - SECTION I
EROSION PREDICTION**

**PREDICTING RAINFALL EROSION LOSSES
THE REVISED UNIVERSAL SOIL LOSS EQUATION (RUSLE)**

The Revised Universal Soil Loss Equation (RUSLE) estimates soil loss from sheet and rill erosion caused by rainfall and its associated overland flow on cropland. For estimating soil loss on pasture, idle land and grazed woodlands use the Universal Soil Loss Equation (USLE). RUSLE, like its predecessor for cropland, the Universal Soil Loss Equation, can be used to predict the average rate of soil sheet and rill erosion for each feasible alternative combination of crop system and management practices in association with a specified soil type, rainfall pattern, and topography. When these predicted losses are compared with given soil loss tolerances, RUSLE provides specific guidelines for effecting erosion control. Neither USLE or RUSLE predict amounts of ephemeral gully erosion. The equation is expressed as follows:

$$A = RKLSCP$$

where:

A = average annual soil loss from inter-rill (sheet) and rill erosion caused by rainfall and its associated overland flow expressed in tons/ac/yr,

R = the factor for climatic erodibility,

K = the factor for soil erodibility measured under a standard condition,

L = the factor for slope length,

S = the factor for slope steepness,

C = the factor for cover-management, and

P = the factor for support practices.

RUSLE is an empirical equation derived from theory of erosion process and more than 10,000 plot years of data from natural runoff plots and an estimated 2,000 plot years of rainfall simulator data. In a typical RUSLE application, values for each of the factors R, K, L, S, C and P are assigned based on site-specific conditions. These factors are multiplied to obtain an estimate of long-term (30-plus years) average soil loss for the specific conditions used to derive the factor values. A more detailed explanation of each factor and how it is derived follows.

The soil loss tolerance (T) is not a part of RUSLE. It is defined as the maximum rate of annual soil loss that will permit crop productivity to be maintained economically and indefinitely. T values are assigned to each soil map unit and are listed in Section II, Soil Legends, Interpretations Groupings of the Field Office Technical Guide.

Erosivity (R) Factor

The erosivity of rainfall can vary a great deal by location. In general, the R factor can be thought of as an indication of the two most important characteristics of a storm determining its erosivity: amount of rainfall and peak intensity sustained over an extended period. For example, erosivity in central Mississippi is about 10 times that in western North Dakota. Some variation also occurs as we move across Iowa with the lowest R in the northwest corner of the state and the highest R in the southeast corner. The R factor represents the differences in erosivity and is county specific.

To obtain the R factor for your county: Select R factors for a specific county from Figure B.

Soil Erodibility (K) Factor

Soils vary in their susceptibility to erosion. The soil erodibility factor K is a measure of erodibility for a standard condition. The standard condition is the unit plot, which is an erosion plot 72.6 ft. long on a 9 percent slope, maintained in continuous fallow, tilled up-and-down hill periodically to control weeds and break up crusts that form on the surface of the soil. County-specific C/K Zones are shown in Figure C.

To obtain the K factor for a soil in your county: Select K factors for a specific soil mapping unit from the K factor column in the Interpretive Groupings Table under Soil Legends in Section II of the FOTG. Select the adjusted K factor from **Table 7**.

Slope Length and Steepness (LS) Factors

The slope length factor (L) computes the effect of slope length on erosion, and the slope steepness factor (S) computes the effect of slope steepness on erosion. Values for both L and S equal 1 for the unit plot conditions of 72.6 ft length and 9 percent steepness. Values for L and S are relative and represent how erodible the particular slope length and steepness is relative to the 72.6 ft long, 9 percent steep unit plot.

Slope length (L): The definition of slope length is the distance from the origin of overland flow along its flow path to the location of either concentrated flow or deposition.

Slope Steepness (S): Determine the appropriate percent slope for the slope length being considered. Use this value in the equation. For push-up, grassed back slope terraces only, reduce the slope steepness by 25 %. For push-up, narrow base terraces reduce the slope steepness by 20 %. If the terrace is not constructed from borrow immediately below the terraces, do not use these reductions.

Determining Slope Length and Steepness

RUSLE computes average soil loss for the selected landscape profile (length and steepness of slope). Many landscape profiles exist in a field, and thus the planner has to choose one or more profiles for the

L and S values. For conservation planning purposes, choose the slope profile representing a significant portion of the field having the most severe erosion.

When the lower end of the slope is steeper than the upper end, the gradient for the steeper segment should be used with the overall slope length to plan and apply erosion control practices.

For irregular slopes and slopes characterized by different soil types, more precision can be obtained by using the irregular slope procedure described on Pages 16 of Agricultural Handbook 537. The computerized version of RUSLE in FOCS is also capable of handling non-uniform slope percentages where they are considered typical for a planning unit.

To obtain LS values: Select **LS** values based on the landscape profile from one of three tables defined below.

Table 8.1: This table is used when inter-rill and rill (sheet) erosion are equal, which is the case for most **cultivated cropland** in row crops and small grains.

Table 8.2: This table is used when most of the soil loss is caused by inter-rill (sheet) erosion. Use this table on **pastureland, woodlands and continuous no-till** where the soil is consolidated and resistant to erosion.

Table 8.3: This table is used when most of the erosion is caused by rill erosion. Use this table for **construction sites** immediately after disturbance. Over time the soil at these sites will consolidate. **Table 8.2** would then be used for this type of erosion prediction.

Cover Management (C) Factor

The cover management represents the effect of plants, soil cover, soil biomass, and soil-disturbing activities on soil erosion. RUSLE uses a subfactor method to compute soil loss ratios, which are the ratios of soil loss in a cover-management sequence to soil loss from the unit plot. Soil loss ratios vary with time as canopy, ground cover, soil biomass and consolidation change. A “C” factor value is an average soil loss ratio weighted according to the distribution of “R” during the year. The subfactors used to compute a soil loss ratio value are canopy, surface cover, surface roughness, and prior land use.

There are four RUSLE Climatic Zones that effect the “C” factors in Iowa as shown in Figure C. Each zone is represented by the climatic data base for a selected city. Those cities are: **87 C/D, Norfolk, NE; 99, Shenandoah, IA; 100B, Minneapolis, MN; 101B, Moline, IL.** “C” factor tables have been generated for each of these zones.

To obtain C values: The “C” factors are shown in **Tables 9.1 - 9.5** based on tillage operation (no-till, mulch-till, ridge-till, strip-till) and high, medium, and low yields. Crop rotation “C” factors can be constructed by selecting the appropriate “C” factor for each crop in the rotation, adding these “C” factors together, and dividing the sum of “C” factors by the number of years in the rotation. Please note the adjustment factor to the no-till values if the no-till in use is not continuous for at least 7 years.

Support Practices (P) Factor

The support practice factor (P) describes the effects of practices like contouring, contour buffer strips, strip cropping, and terraces. Most support practices affect erosion by redirecting runoff or reducing its transport capacity. Redirection of the runoff frequently results in deposition and reduced erosion. The “P” factor value used in the RUSLE equation is a combination of subfactors which represent the actual field conditions. Determining the appropriate “P” factor first requires calculation of “P_c” for contouring or cross-slope farming from Table 10. If it is appropriate, the “P” subfactors for stripcropping “P_s” from Table 4 or % and/or terracing “P_t” from Table 6 are multiplied by “P_c” to determine “P”.

To calculate P subfactor use the instructions and tables presented in this section.

RUSLE “P_c” Subfactor values for Contour and Cross/slope farming

Step 1. Gather appropriate information.

- a) Identify the hydrologic soil group for the selected soil. See Section II, Cropland Interpretation, of the Field Office Technical Guide. Hydrologic soil groups may also be found in the County Survey Reports under Soil and Water feature Tables.
- b) Determine slope length (“L”) and slope steepness (“S”) of the landscape profile, and determine the grade along the ridges/furrows that is the result of tillage, planting and/or row cultivation operations..
- c) Identify the 10-yr storm erosivity (10-yr EI) value (Figure D).
- d) Select the cover management condition using **Table 1** "Cover Management Conditions". Use a single Cover Management Condition code that represents the cropping system or rotation as a whole. Consider the amount of runoff and infiltration that will occur with the crop rotation. For cropland situations, cover management conditions 3-6 are generally appropriate.
- e) Select the appropriate ridge height to represent the cropping system or rotation using **Table 2** "Guidelines for Selecting Ridge Heights for Contouring with RUSLE".

Step 2. Determine the “P_c” subfactor for contouring.

- a) With 10-yr EI value, hydrologic soil group, and cover-management condition, select the appropriate page from **Table 10**, "P Subfactor for Contouring
- b) .Select the table for the appropriate Ridge Height.
- c) Determine the appropriate contour condition or the percent row grade. See Page ? “Selection Criteria for Table 10”.
- d) Using the contour condition or row grade selected from step2c follow that column down to the point where it intersects with the line for the percent land slope (S) for the site. The resulting value is the “P_c” subfactor value for contouring.

Step 3. Determine the critical slope length limits.

- a) **Table 3, “Slope Length Limits for Contouring”** provides a quick determination of critical slope length. Table 3 is divided into four sections, based on hydrologic soil groups. Find the appropriate section for hydrologic soil groups, cover Management Code and move across until you are under the appropriate percent slope. The number in this space is the Critical Slope Length for the condition selected.
- b) Contour Strip cropping increases the contour slope length limit determined above by a factor of 1.5.
- c) If the actual slope length in the field is shorter then the number shown in the space, then the field is not critical. If the field slope is longer than the critical length determined from Table 3 then the slope length is critical and the Pc must be adjusted.
- d) Where landscape profile slope exceeds the slope length limits, use the following formula to calculate the effective P subfactor:

$$\text{Effective P} = 1 - [(\text{Slope Length Limits}/\text{Total Slope Length}) \times (1 - P)]$$

Step 4. Adjust contouring P subfactor where cover-management conditions and/or ridge heights change from year-to-year throughout the crop rotation.

- a) Where the crop rotation planned for the field will cause cover-management conditions and/or ridge heights to change from year-to-year, calculate the average annual P subfactor. It is the weighted average of the P subfactors calculated for each cover management condition and ridge height presented during the critical erosion period for each year in the life of the rotation.
- b) For each cover management condition and ridge height presented by each year in the crop rotation during the critical erosion period, calculate the contour P subfactor following the appropriate steps 1-4 above.
- c) Multiply the contour Pc subfactor value for crops with the same cover-management condition and ridge height by the number of the years they occur in the rotation.
- d) Sum these different sets of multiplied values and divide by the total years in the rotation.

Strip Cropping

Determine the “Ps” subfactor for stripcropping.

In order to calculate a “Ps” subfactor for contour stripcropping, first calculate a “Pc” for contouring.

Step 1. Gather required information. Note that some of the information is the same as used for evaluating contouring.

- a) Identify the hydrologic soil group for the soil map unit(s) on the selected landscape profile.
- b) Identify the 10-yr storm erosivity (10-yr EI) value for the site from Figure D.
- c) Determine the number of strips that can be laid across the landscape profile slope length “L”. A minimum of two full strip widths must fit on the slope.
- d) For a strip pair, select the Cover-Management Conditions that will be the opposite each other during the life of the crop rotation using Table 1, “Cover Management Conditions.” Established hay is considered Cover Management Condition 1.

Step 2. Use Table 4 where annual crops are in alternating strips with a perennial crop. I.E. 50% of the rotation is perennial hay. Use Table 4.1 where annual crops generally are in alternating strips with a perennial crop but there may be one year where annual row crops are in alternate strips with an annual small grain. I.E. 3 years of the rotation are annual row crop, one year of the rotation is a small grain and 2 years of the rotation are perennial hay.

For either Table 4 or 4.1 first select the cover management code pairing which best represents the site conditions. Then under that cover management code pairing box find the appropriate number of strips that occur on L. Follow that column down to where it intersects with the row that represents the hydrologic soil group. The value in that box is the “Ps” for stripcropping.

Multiply this “Ps” times “Pc” to determine the composite “P”.

Contour Buffer Strips

Determine the “Ps” subfactor for contour buffer strips.

Step 1. Gather required information. Note that some of the information is the same as used for evaluating contouring.

- a) Identify the hydrologic soil group for the soil map unit(s) on the selected landscape profile.
- b) Identify the 10-yr storm erosivity (10-yr EI) value for the site from Figure D.
- c) Determine the number of strips that can be laid across the landscape profile slope length “L”. A minimum of two full strip widths must fit on the slope.
- d) For a strip pair, select the Cover-Management Conditions that will be the opposite each other during the life of the crop rotation using Table 1, “Cover Management Conditions.” Established hay is considered Cover Management Condition 1.
- e) Determine the percent of the landscape profile to be occupied by buffer strips that are at least 15 feet wide. Table 5 is set up for 10 and 20 percent of the landscape profile. Table 5 presents these as crop strip to buffer strip ratios of 9:1 and 4:1 respectively. The minimum landscape profile length that can benefit from buffer strips is 150 feet.

Step 2. Locate the Buffercropping subfactor value at the intersection of the number of strips and the Cover Management conditions of the strips. Enter the correct column for ratio of cultivated crop strip to buffer strip. The value, at the intersection, is the stripcropping “Ps” subfactor.

Multiply this “Ps” times “Pc” to determine the composite “P”.

Terraces

Determine the “Pt” subfactor for Terracing.

Step 1. Gather information for use in RUSLE.

- a) Determine the slope gradient of the landscape profile. Will it change with construction of terrace? If yes, determine new slope gradient.
- b) Determine terrace horizontal spacing interval using **Table 2** from **page 600-2, NHCP, Terrace** conservation practice standard, as a guide. Check maximum and minimum spacing requirements for the proper slope. Minimum spacing interval is given at the bottom of **Table 2**. If terrace(s) will be used in conjunction with contour stripcropping, read across to spacing interval in feet under “With Contour Stripcropping” column.
- c) Decide whether terrace will have an open or closed outlet.
- d) If an open outlet, decide channel grade of terrace at outlet end. If channel grade is 0.8 or greater, skip step 2, practice factor equals 1.0, do proceed with step 3.

Step 2. Determine terrace Pt subfactor.

From **Table 6**, select proper horizontal spacing interval range row. Read across to the selected outlet type. If an open outlet is the design choice, then select the terrace channel grade range column that describes the design terrace channel grade. Read the P subfactor value at the row-column intersection.

Step 3. If terrace horizontal spacing interval is less than landscape profile slope length, recalculate LS value to reflect shorter sheet and rill erosion flow length.

- a) If significant earth moving will cause a change in landscape profile slope, recompute landscape profile slope.
- b) From appropriate **LS Table 8.1-8.3** estimate terrace spacing interval length by going across table column heading until slope length in feet equals terrace interval. Read down column until you intersect correct percent slope. This is the new adjusted LS factor value. Enter this value in place of the original value estimated before terraces were used to split the original landscape profile. If terrace spacing falls between two slope length column headings, interpolate if more precision is desired.

Multiply this “Ps” times “Pc” to determine the composite “P”.

TABLE 1 - COVER MANAGEMENT CONDITIONS

Select the cover and management condition that best describes the condition during the 1/4 of the year when rainfall and runoff are most erosive and the soil is most susceptible to erosion. Use a single Cover Management Condition Code that represents the cropping system or rotation as a whole. Example: For a rotation with 50% forages and not more than 2 years of row crop (CCOHHH) use Cover Management Condition Code 3 – Heavy Cover.

Description of cropland cover-management conditions used in RUSLE for estimating P-factor values.

Cover-Management Condition	Description
Code 1. Established Meadow.	In this condition, the grass is dense and runoff is very slow, about the slowest under any vegetative condition.
Code 2. 1st year meadow, hay.	In this condition, the hay is a mixture of grass and legume just before cutting. The meadow is a good stand of grass that is nearing the end of the first year.
Code 3. Heavy Cover and/or very rough	Ground cover for this condition is about 75 to 95%. Roughness would be like that left by a high clearance moldboard plow on a heavy textured soil. Roughness depressions would have the appearance of being 7 inches deep and deeper. Vegetative hydraulic roughness would be like that from a good legume crop, such as lespedeza, that has not been mowed.
Code 4. Moderate cover and/or rough.	The ground cover for this condition is about 40 to 65%. This roughness would be like that left by a moldboard plow in a medium textured soil. Depressions would have the appearance of being about 4 to 6 inches deep. Vegetative hydraulic roughness would be much like that produced by winter small grain at full maturity.
Code 5. Light cover and/or moderate roughness	Ground cover is between 10 and 35% and the surface roughness is like that left by the first pass of a tandem disk over a medium texture soil that has been moldboard plowed. This roughness could also be much like that left after a chisel plow through a medium textured soil at optimum moisture conditions for tillage. Roughness depressions would have the appearance of being on the order of 2 to 3 inches deep. In terms of hydraulic roughness produced by vegetation, this condition is much like that produced by spring small grain at about three fourths maturity.
Code 6. No cover and/or minimal roughness	This condition is like the condition typically found in row cropped fields after the field has been planted and exposed to a moderately intense rainfall. Ground cover is less than about 5% and the roughness is characteristic of a good seedbed for corn or soybeans. The surface is rougher than that of a finely pulverized seedbed for seeding vegetables or grass.
Code 7. Clean-tilled, smooth, fallow	This condition is essentially bare with a cover of 5% or less. The soil has not had a crop grown on it in the last 6 months or more. Much of the residual effects of previous cropping have disappeared. The surface is smooth, much like the surface exposed to several intense rainfalls. This condition may be found in fallowed and vegetable fields, or in newly sown lawns and hay fields.

TABLE 2 - GUIDELINES FOR SELECTING RIDGE HEIGHTS FOR CONTOURING

Select the ridge height that best describes the condition during the 1/4 of the year when rainfall and runoff are the most erosive and the soil is most susceptible to erosion. Select a single ridge height to represent the cropping system or rotation.

1. VERY LOW (0.5 - 2 in.) RIDGES

- Plants not closely spaced, but with a perceptible ridge height
- No-till planted crop rows
- No-till drilled crops when stems do not restrict runoff or pond water.
- Fields that have been rolled, pressed or dragged after planting
- Conventionally drilled crops when erosive rains occur during or soon after planting
- Clear seeded hay that leaves a very low ridge

2. LOW (2 - 3 in.) RIDGES

- No-till drilled crops when stems are close enough to restrict runoff and pond water
- Mulch tilled row crops with no row cultivation
- Conventionally planted row crops with no row cultivation
- Winter small grain when runoff from snowmelt occurs during winter and early spring
- Transplanted crop, widely spaced

3. MODERATE (3 - 4 in.) RIDGES

- Conventionally (clean) tilled row crops with row cultivation
- Mulch till systems with row cultivation
- High yielding winter small grain crops when erosive rains are concentrated in the late spring after plants have developed a stiff upright stem.
- Transplanted crops that are closely spaced and/or in narrow rows

4. HIGH (4 - 6 in.) RIDGES

- Ridge tilled crops with high (4 - 6 in.) ridges during periods of erosive rain.

5. VERY HIGH (Greater than 6 in.) RIDGES

- Ridge tilled crops with very high (6+ in.) ridges during periods of erosive rains
- Hipping, bedding or ridging with very high ridges during periods of erosive rains

Table 3
Critical Slope Length Limits (Ft)
For Contouring
10 yr Storm EI=80

Soil Hydrologic Group A

Slope Group

Cover Factor	0-2%	2-5%	5-9%	9-14%	14-18%	18-25%
3	N/A	N/A	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	720	520	380
6	N/A	N/A	400	220	160	120

Soil Hydrologic Group B

Slope Group

Cover Factor	0-2%	2-5%	5-9%	9-14%	14-18%	18-25%
3	N/A	N/A	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A	720	500
5	N/A	N/A	720	380	280	200
6	N/A	N/A	300	160	120	80

Soil Hydrologic Group C

Slope Group

Cover Factor	0-2%	2-5%	5-9%	9-14%	14-18%	18-25%
3	N/A	N/A	N/A	N/A	N/A	900
4	N/A	N/A	N/A	720	520	360
5	N/A	N/A	560	300	220	160
6	N/A	N/A	220	140	100	60

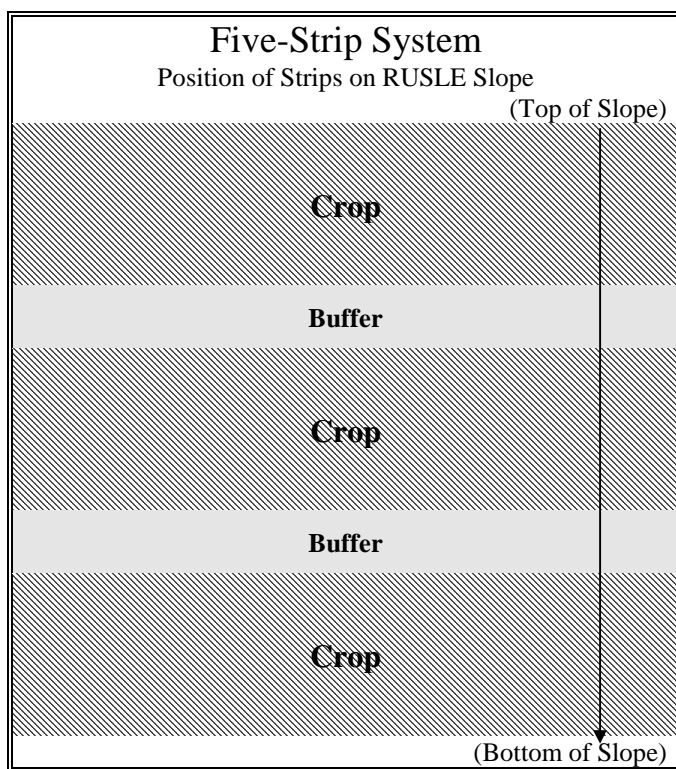
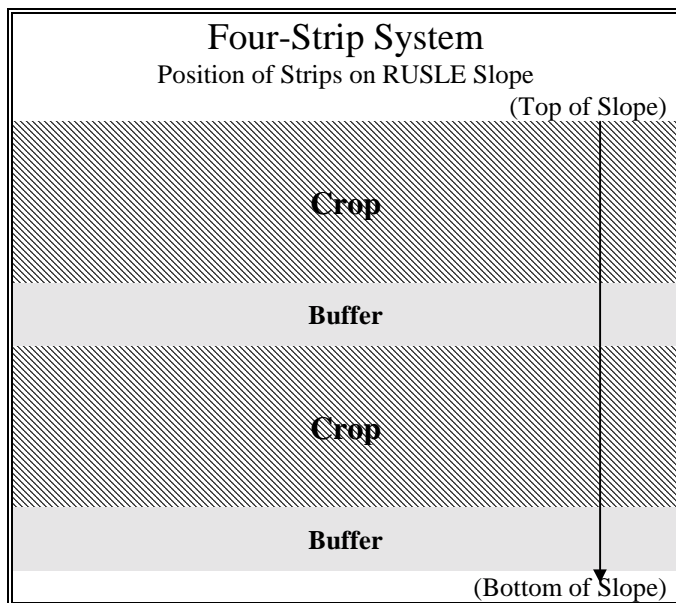
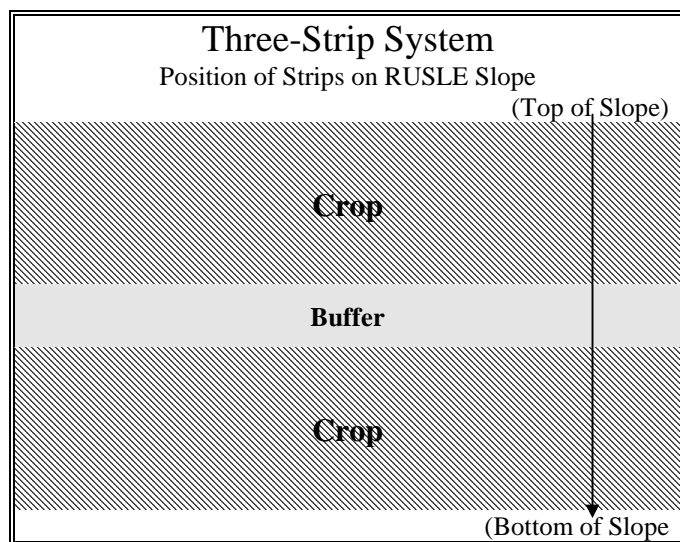
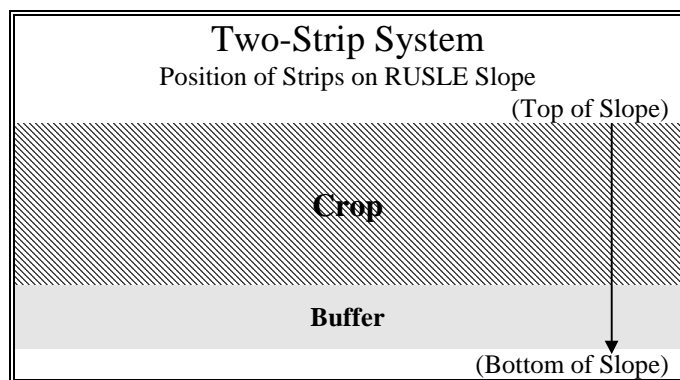
Soil Hydrologic Group D

Slope Group

Cover Factor	0-2%	2-5%	5-9%	9-14%	14-18%	18-25%
3	N/A	N/A	N/A	N/A	N/A	760
4	N/A	N/A	N/A	640	460	320
5	N/A	N/A	480	260	180	140
6	N/A	N/A	220	120	80	60

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Figure A: Graphical representation of two, three, four and five strip contour buffer strip systems.



Note: Some deviation from the relative position of the strips as shown here is to be expected and is allowed.

See Table 4

Table 5
Contour Buffer Strips - Ps Subfactor
10% of L in Buffers
EI = 50

Row Crop Cover Manage ment Code	6	6	5	5	4	4	3	3
	Number of Strips on L							
Hydrolo gic Soil Group	2	3	2	3	2	3	2	3
A	0.89	0.74	0.89	0.74	0.90	0.74	0.90	0.96
B	0.89	0.79	0.90	0.78	0.90	0.80	0.93	0.93
C	0.90	0.83	0.90	0.84	0.91	0.87	0.96	1.00
D	0.90	0.85	0.91	0.86	0.92	0.89	0.98	1.00

Table 5
Contour Buffer Strips - Ps Subfactor
20% of L in Buffers
EI = 50

Row Crop Cover Manage ment Code	6	6	6	5	5	5	4	4	4	3	3	3
	Number of Strips on L			Number of Strips on L			Number of Strips on L			Number of Strips on L		
Hydrolo gic Soil Group	2	3	4	2	3	4	2	3	4	2	3	4
A	0.78	0.71	0.66	0.79	0.92	0.67	0.78	0.92	0.91	0.78	0.92	0.91
B	0.79	0.79	0.72	0.80	0.78	0.72	0.81	0.80	0.75	0.88	0.94	0.89
C	0.79	0.83	0.76	0.80	0.83	0.77	0.83	0.87	0.81	0.94	1.00	0.97
D	0.80	0.85	0.77	0.81	0.86	0.79	0.84	0.90	0.83	0.98	1.00	0.99

Table 6 - Terrace P Subfactor Table

Horizontal Interval (ft.)	Closed Outlets ^{/1}	Open outlets, with percent grade of ^{/2}		
		0.1 - 0.3	0.4 - 0.7	0.8
less than 110	.5	.6	.7	1.0
110-140	.6	.7	.8	1.0
140-180	.7	.8	.9	1.0
180-225	.8	.8	.9	1.0
225-300	.9	.9	1.0	1.0
More than 300	1.0	1.0	1.0	1.0
<p>Note: If contouring or stripcropping P factors are appropriate, they can be multiplied by the terrace P factor for the composite P factor.</p> <p>^{/1} - P factors for closed-outlet terraces also apply to terraces with underground outlets and to level terraces with open outlets.</p> <p>^{/2} - The channel grade is measured on the 300 ft of terrace or the one-third of total terrace length closest to the outlet, whichever distance is less.</p>				

Selection Criteria for Table 10
Pc Subfactor
For
Contouring and Cross-slope Farming

Criteria for Selection of Contour Code or Percent Row Grade

Contour Code	Use For	Where
A	Contour Stripcropping	the hillslope is relatively undissected by ephemeral gullies and/or concentrated flow channels, and where contouring is well designed and contour lines well laid out along the grade
B	Contour Stripcropping	the hillslope is moderately dissected by ephemeral gullies and/or concentrated flow channels and, where contouring is well designed and contour lines well laid out along the grade
B	Contouring	the hillslope is relatively undissected by ephemeral gullies and/or concentrated flow channels, and where contouring is well designed and contour lines well laid out along the grade
C	Contouring	the hillslope is moderately dissected by ephemeral gullies and/or concentrated flow channels, and where contouring is well designed and contour lines well laid out along the grade
Percent Row Grade	Row grade measured in the field	the hillslope is highly dissected by ephemeral gullies and/or concentrated flow channels, and where a level grade cannot be maintained because of either large equipment or complex topography

Criteria for Selection of Cover Management Condition Code

See Table 1 – Cover Management Conditions

Criteria for Selection of Ridge Height

See Table 2- Guidelines for Selecting Ridge Heights for Contouring

Guidelines for Adjustment of Current No-Till C Factors.

The current no-till C factors dated June 1997 developed for the FOTG represent pure no-till management systems. The current FOTG no-till C factors do not represent situations where no-till is alternated with a full width tillage system or where tillage is performed even as little as every four or five years. In order to use the current FOTG no-till C factors in these situations the following adjustments must be applied:

- 1) Where no-till is alternated in a two-year rotation with some type of full width tillage system.
Example: In a corn, soybean rotation the corn is no-tilled into the soybean stubble, and the soybeans are planted using a spring mulch till system.
The C factor from the FOTG is not appropriate. The C factor to be used is the lesser of the no-till C factor for the appropriate residue level **multiplied by 2** or the Spring Mulch Tillage C factor for the appropriate residue level.

EXAMPLE: Spring mulch till corn after beans 20% residue use the spring mulch till chart. No-till wide row beans after corn 60% residue use no-till chart for C-factor $.034 \times 2 = .068$.

- 2) Where no-till is tilled at some interval other than every other year. This could be once every 3 years up to once every 6 years.
Example: Corn is planted using no-till for 4 years in a row. During the fifth year the producer uses a mulch tillage system to plant the corn.
The no-till C factors from the FOTG are not appropriate for this system. The C factor to be used is the lesser of the no-till C factor for the appropriate residue level **multiplied by 1.5** or the Spring Mulch Tillage C factor for the appropriate residue level.

EXAMPLE: Corn, Corn Bean rotation with corn no-tilled after corn 70% residue, beans no-tilled after corn 40% residue and corn spring mulch tilled after beans 20 % residue. For the no-till corn after corn 70% residue use no-till chart for C-factor $.022 \times 1.5 = .033$. The no-till wide row beans after corn 60% residue use no-till chart for C-factor $.034 \times 1.5 = .051$. Spring mulch till corn after beans 20% residue use the spring mulch till chart.

- 3) Where no-till system is used consistently for a minimum of 7 years the current no-till factors listed in Table 9 are to be used.